

NASA TECHNICAL MEMORANDUM

NASA TM-76337

(NASA-TM-76337) CERTAIN FEATURES OF THE
COCHLEOVESTIBULAR SYNDROME IN THE RESIDUAL
STAGE OF TRAUMATIC BRAIN DISEASE (National
Aeronautics and Space Administration) 12 p
NC A02/MF A01

N80-32073

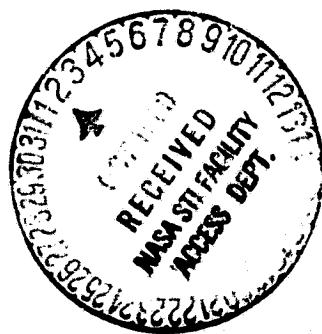
Unclassified
CSCL 06 E G5/52 28687

CERTAIN FEATURES OF THE COCHLEOVESTIBULAR SYNDROME IN THE
RESIDUAL STAGE OF TRAUMATIC BRAIN DISEASE

M. I. Garshin and V. Ye. Volyanskiy

Translation of "Nekotoryye osobennosti kokhleovestibulyarnogo
sindroma rezidual'noy stadii travmatischeskoy bolezni golovnogo
mozga," Vestnik otorinolaringologii, No. 2 (Mar-Apr), 1980, pp.
37-41

REPRODUCTION RESTRICTIONS OVERIDDEN
NASA Scientific and Technical Information Facility



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON D.C. 20546 AUGUST 1980

STANDARD TITLE PAGE

1. Report No. NASA TM-76337	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle CERTAIN FEATURES OF THE COCHLEOVESTIBULAR SYNDROME IN THE RESIDUAL STAGE OF TRAUMATIC BRAIN DISEASE.		5. Report Date AUGUST 1980	
7. Author(s) M. I. Garshin, V. Ye. Volyanskiy		6. Performing Organization Code	
8. Performing Organization Report No.		10. Work Unit No.	
9. Performing Organization Name and Address SCITRAN Box 5456 Santa Barbara, CA 93108		11. Contract or Grant No. NASW-3198	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		13. Type of Report and Period Covered Translation	
14. Sponsoring Agency Code			
15. Supplementary Notes Translation of "Nekotoryye osobennosti kokhleovestibulyarnogo sindroma reidual'noy stadii travmaticheskoy bolezni golovnogo mozga," Vestnik otorinolaringologii, No. 2 (Mar-Apr), 1980, pp. 37-41			
16. Abstract Caloric and rotation tests were applied to the study of the vestibular analyser in 84 patients in the residual state of traumatic disease of the brain. Vestibular disturbances of different degree revealed in 79 patients were as a rule accompanied by cochlear derangement. In the majority of patients the vestibular syndrome was supratentorial with the involvement of the diencephal-hypothalamic, subcortical, and cortical levels of the brain. Vestibular dysfunction correlated with such factors as severity of the sustained craniocerebral traum, duration of the post-traumatic period, and, particularly, with the character of the residual neurological syndrome. In accordance with the latter, it is recommended that vestibular disturbances be treated in the residual period of closed craniocerebral injuries with due regard for the principal pathophysiological mechanisms of the underlying neurological syndrome.			
17. Key Words (Selected by Author(s))		18. Distribution Statement THIS COPYRIGHTED SOVIET WORK IS REPRODUCED AND SOLD BY NTIS UNDER LICENSE FROM VAAP, THE SOVIET COPYRIGHT AGENCY. NO FURTHER COPYING IS PERMITTED WITHOUT PERMISSION FROM VAAP.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 12	22.

UDC 617.51-001-036.86-07:616.833.18-008.6-072.7

CERTAIN FEATURES OF THE COCHLEOVESTIBULAR SYNDROME
IN THE RESIDUAL STAGE OF TRAUMATIC BRAIN DISEASE

By M. I. Garshin and V. Ye. Volyanskiy*

In the residual period of closed craniocerebral trauma (CCCT) different cochleovestibular disorders are often observed. T. V. Novochadovskaya (1965) revealed cochleovestibular dysfunction in all examined patients with after-effects of CCCT. Vestibular symptoms had been noted by N. S. Blagofeshchenskaya (1976) in 76 out of 82 patients with residual phenomena of CCCT. Similar disorders in the given pathology have also been described by other authors (M. E. Kolik, 1939; G. S. Tsimmerman, 1945; V. I. Voyachek, 1946; A. R. Polyakov, 1948; S. Ya. Gol'din, 1951; T. N. Golovan', 1972; Ya. Zelenka, 1963; A. P. Kotova, 1964, 1967; M. I. Sutin, 1967; N. S. Martynova and E. L. Golland, 1971; M. V. Kulikova, 1972; I. M. Mayerovich, 1975; S. I. Sheps, 1975; Schöder, 1955; Weedhegen, 1960, and others). /37**

We examined 84 patients in the residual stage of traumatic brain disease, 57 were men and 27 were women. There were two patients under 20, 13 from 20 to 29, 27 from 30 to 39, 17 from 40 to 49, 18 from 50 to 59, and 7 from 60 to 69. In 33 patients less than a year had passed since the injury was obtained, in

Odessa oblast Psychoneurological Clinic

***Numbers in margin indicate pagination in original foreign text*

10--from 1 to 2 years, in 10 from 2 to 5 years, in 5 from 5 to 10 years, and in 26 patients over 10 years. The CCCT was classified according to origin as follows: road transportation (in 28 patients), everyday (in 28), gun (in 15), production (13 patients). The following groups were isolated according to the nature of the CCCT: with brain concussion (49), with brain contusion in anamnesis (23), with traumatic intracranial hemorrhages (7), with basilar skull fracture (5 patients).

The vestibular function in patients under observation was studied by the method of caloric and rotational test. The latter was mainly used to pinpoint the degree of excitability of the vestibular apparatus. In conducting the caloric test initially 60 ml of fluid were used. However, this amount was not always a sufficient stimulus to reveal the vestibuloautonomic reaction. Further, according to the method of N. S. Blagoveshenskaya, 100 ml of liquid were used at a temperature of 20°C (optimal stimulation of the vestibular apparatus), which promoted a more distinct detection of the vestibulo-autonomic reactions in patients who had suffered CCCT. In order to evaluate the excitability of the vestibular apparatus such indices were also considered as duration of the latent period, time of nystagmus, autonomic and sensory reactions, as well as the reactive deviation of arms and torso. In order to determine the quantitative and qualitative reactions of the vestibular apparatus to caloric stimulation, the indicated test was conducted in the control group (18 people) in age from 17 to 25. The subjects had never suffered diseases of the cochleovestibular apparatus, and they had no complaints. /38

In 84 patients in response to the caloric stimulus the following reactions of the vestibular apparatus were revealed: areflexia (in 43 patients), hypo-

reflexia (in 16), normoreflexia (5) and hyperreflexia (in 20).

In hyporeflexia of the vestibular apparatus there is a more reliable reduction as compared to the normal in the duration of nystagmus ($P<0.001$), while the increase in the latent period is statistically insignificant ($P>0.1$). In hyperreflexia the opposite trend is observed--as compared to the normal the duration of the latent period is reduced more significantly ($P<0.001$) than the time of nystagmus is increased ($P<0.01$).

Thus, in the residual period of traumatic brain disease the vestibular reactions of torpid type dominated, of the 84 subjects the total number of patients with a disorder in caloric nystagmus was 79. Asymmetrical reactions in the vestibular apparatus were observed in 34 patients with residual phenomena of CCCT. The asymmetry we found had the following nature: areflexia, on one side, hyporeflexia on the other (in 21 patients), normoreflexia-hyporeflexia (in 5), normoreflexia-hyperreflexia (in 3), normoreflexia-areflexia (in 3) and hyporeflexia-hyperreflexia (in 2).

In addition to a disorder in the caloric test other vestibular disorders were found in the patients. Thus, in 56 of the 84 patients vertigo was observed, primarily of the nonsystems nature, and disorders in equilibrium. In 26 patients multiple spontaneous nystagmus was noted. Between the subjective disorders (vertigo) and the data of an objective study of the vestibular apparatus by means of the caloric test the following correlations were revealed. Vertigo was observed in 32 of the 43 patients with areflexia of the labyrinth, in 15 of the 20 patients with hyperreflexia, in 6 of the 16 patients with hyporeflexia, and in 3 of the 5 patients with normoreflexia. Based on this one can draw a conclusion about the absence of any parallels between vertigo

and the nature of the labyrinth reaction to the caloric stimulation.

The degree of pronouncement of the vestibulo-autonomic reactions after stimulus of the vestibular apparatus was determined according to K. L. Khilov. As a result, a reaction of zero degrees was established in 8 patients, I in 17 patients, II in 24 patients and III degree in 35 patients. The majority of patients with traumatic brain disease reacted to the stimulation of the vestibular apparatus (especially after rotation) with sharply pronounced sensory and autonomic phenomena. This was confirmed also by the data of rheoencephalography, conducted during the study of the vestibular apparatus of 33 patients. The rheoencephalograms were recorded before conducting of the vestibular test (background) and directly after it. As a response reaction of the cerebral vessels to calorization of the labyrinth, in 26 patients vasodilation was established, and in 7 vasoconstriction. As a rule, here the dystonic reactions of the cerebral vessels were considerably intensified. The vasodilating reaction was observed most often on the background of hyporeflexia of the vestibular apparatus, vasoconstricting dominated in patients with hyperreflexia. /39

We attempted to establish a relationship between the nature of the vestibular reaction and the time since the craniocerebral injury was received. The hyperreflexia of the labyrinth dominated in patients with duration of the process of 1 year (10 of the 20 patients). Hyperreflexia was revealed in 3 of the subjects with duration of injury from 1 year to 2 years, in 3 with duration of injury from 2 to 5 years, and in 4 of the 26 patients with injury over 10 years in length.

The distribution of patients with hyporeflexor vestibular reaction on a scale of duration of the traumatic brain process in our observations was not

subordinate to any kind of law. Hyporeflexia was revealed more often (in 12 out of 16 patients) with duration of the traumatic process no more than 5 years. Areflexia of the labyrinth was found fairly often (in 16 out of 33 patients) at the earliest stage of the residual period of craniocerebral injury, however such a reaction dominated in 19 out of 26 patients with residual phenomena of more than 10-year length. Normoreflexia was observed in 5 patients with duration of the trauma under 1 year. Based on the findings we can note, that although in the residual period of craniocerebral damages a tendency exists for its dominance of vestibular reactions of the torpid type, nevertheless this tendency does not have a strict law governing it.

This stimulated us to search for new factors that determine the nature of the vestibular reactions. For this purpose an analysis was made of the dependence of the labyrinth reaction on the severity of the injury: in the residual period of brain concussion of light degree areflexia and hyperreflexia of the vestibular apparatus dominated (respectively in 14 and 13 patients of the 27 patients with brain concussion of light degree in anamnesis). Areflexia dominated also in the residual period of brain concussion of average severity (in 6 out of 11 patients). However the dominance of areflexia in the vestibular apparatus was more reliable after contusion of the brain (in 17 out of 23 patients). Thus, the second factor that determines the nature of vestibular reaction in the residual period of craniocerebral damages is severity of the experienced injury. Normo-and hyperreflexia of the vestibular apparatus are more inherent to light injuries, while serious injuries, especially contusions of the brain, as well as injuries that are accompanied by intracranial hemorrhages and basilar skull fractures result in the development of labyrinth areflexia.

Yet another factor that can affect the type of vestibular reaction is the nature of the leading neurological syndrome in the residual period of cranio-cerebral injury. After analyzing patients for the given criterion, we obtained results, according to which areflexia and hyporeflexia of the labyrinth are observed most often in patients with cerebrasthenic syndrome, whose main pathological mechanism is a disruption in the interrelationship of the stimulating and inhibiting process with dominance of the latter, which apparently has an inhibiting effect also on the vestibular analyzer, especially on its cortical region. Hypo-and areflexia were established in 29 of 44 patients with post-traumatic cerebrasthenia.

The psychoautonomic syndrome was second in frequency of syndrome on whose background hypo-and areflexia of the vestibular apparatus developed. In this syndrome, besides the cerebral cortex, the limbic-reticular complex of the brain stem and the diencephalic region are involved in the process. In the given case the vestibular structures of the stem, including the nuclear formations are affected. Hypo-and areflexia were revealed in 24 of the 36 patients with psycho-autonomic syndrome. Intracranial liquor hypertension was also one of the pathogenetic mechanisms for hypo-and areflexia of the vestibular apparatus (in 15 out of 17 patients with hypertension-liquor syndrome) developing in the residual period of the CCCT. The main point for application of the factor of increased liquor pressure is the ventricular system of the brain, in particular, the lateral sections of the bottom of the IV ventricle with the vestibular nuclei located there. Hyperreflexia of the vestibular apparatus was observed most often on the background of psycho-autonomic syndrome, as a result of the irritating injuries to the stem structures. /40

Thus, the vestibular reactions in the residual period of closed cranio-cerebral trauma are determined by three factors; severity of the injury, duration of the post-traumatic period and nature of the leading neurological syndrome or set of syndromes. The latter circumstance in our opinion, is the primary one in the formation of the vestibular reaction in these patients.

In order to pinpoint the localization of the injury to the vestibular analyzer we conducted threshold and suprathreshold tonal audiometry in 53 patients. During hyperreflexia the vestibular apparatus in 10 patients the perception of high frequencies was reduced, in 8 hearing was reduced according to the type of sound conducting injury. In hyporeflexia in 9 patients perceptive hypoacusis was revealed, and in 6--a mixed form of hypoacusis; during areflexia in 12 a considerable decrease in hearing was established in the range of all frequencies, and in 8 a mixed form of hypoacusis was found with the dominance of elements of sound conducting injury. In 7 examined patients disassociation was noted between the tonal and speech hearing, which indicates the injury to be the central section of the auditory analyzer.

It follows from the data given above, that the cochleovestibular syndrome of residual period of closed craniocerebral injuries that are not accompanied by fracture of the pyramid of temporal bones, is mixed in origin, since it has signs of injury of both the peripheral and central regions of the analyzer. However, in this unified syndrome disassociation of the cochlear and vestibular disorders is observed. While the cochlear disorders are primarily peripheral in origin, among the vestibular disorders the central vestibular syndrome dominates. In localization this is the supratentorial syndrome of diencephalic-hypothalamic, subcortical and cortical levels with the presence of vestibular

asymmetries expressed in vestibulosensory and vestibuloautonomic reactions.

Taking into consideration the primary dependence of the type of vestibular disorders on the nature of the leading neurological syndrome in the residual period of closed craniocerebral damages, one should conduct efficient therapy of these disorders according to the pathogenetic principle. For this purpose it is necessary in the first place to affect the main pathophysiological mechanisms for the traumatic process. Thus, with a disorder in the interrelationship between the main nerve processes accompanied by vestibular disorders, the basis for pathogenetic therapy should be drugs that yield a neuroleptic and neuro-analeptic effect. For a sedative effect preparations can be selected from the group of tranquilizers, especially derivatives of benzodiazepine: seduxen, elenium, napoton, tazepam and phenazepam. According to our observations, in the cases of vestibular disorders on the background of a dominance in inhibitory processes in the central nervous system caffeine has a good effect.

With a disorder in the processes of cerebral hemodynamics of traumatic genesis with dominance of vasospastic phenomena such vascular substances as nicotinic acid, halidor and especially stugeron are effective in influencing the vestibular disorders; the latter is most indicative during vertigo of vascular genesis. Vestibular disorders on the background of a psychoautonomic syndrome can be corrected by means of vegetotropic action. In the given case such preparations are indicative as bellaspon, belloid, bellataminal (lenbiren), seduxen, phenazepam, phrenolon; with a dominance of autonomic disorders of sympathetic-adrenal type, one can recommend pirroxan, that has a selective alpha-adrenalitic effect. The hypertension-liquor syndrome that is accompanied by vestibular disorders requires the use of dehydrating substances. In

/41

addition, during vestibular dysfunction, one can use different combinations of cholinolytic and antihistamine preparations; sometimes acupuncture has a good reflex effect.

Thus, in the residual period of CCT, in the majority of cases cochleo-vestibular disorders are noted, therefore in a complex treatment of the traumatic brain disease it is necessary to include resources directed towards regulating the function of the cochlear and vestibular analyzers.

REFERENCES

1. Blagoveshchenskaya, N. S. Klinicheskaya otoneurologiya pri porazheniyakh golovnogo mozga ["Clinical Otoneurology in Brain Damages"], Moscow, 1976.
2. Voyacheck, V. I. Vestn. otorinolar., No 6 (1946), p 12-16.
3. Golovan', T. N. in Nauchnaya konf. neurokhirurgov USSR. Materialy ["Scientific Conference of Neurosurgeons of the Ukrainian SSR. Materials"], Zaporozh'ye, 1972, p 31-32.
4. Gol'din, S. Ya. in Bolezni usha, gorla, nosa ["Diseases of Ear, Nose and Throat"], Moscow, 1951, p 155-174.
5. Zelenka, Ya. Zh. ushn., nos. i gorl. bol., No 1 (1963), p 24-27.
6. Ioselevich, F. M. Vestn. otorinolar., No 3 (1947), p 41-44.
7. Kolik, M. E. Vopr. neurokhir., No 5 (1939), p 50.
8. Kolomiychenko, A. I. Zh. ushn., nos. i gorl. bol., No 1 (1936), p 33-35.
9. Kotova, A. P. Vopr. neurokhir., No 3 (1964), p 12-16.
10. Kotova, A. P. Vestibulyarnyye narusheniya v ostrom periode tyazheloy cherepno-mozgovoy travmy ["Vestibular Disorders in Acute Period of Severe Cranio-Cerebral Trauma"], candidate dissertation, Moscow, 1967.
11. Kulikova, M. V. in Nauchnaya konf. neurokhirurgov USSR. Materialy, Zaporozh'ye, 1972, p 32-33.
12. Mayerovich, I. M. Travma golovnogo mozga i slух ["Brain Injury and Hearing"], Leningrad, 1975.

13. Martynova, N. S.; and Golland, E. L. Vestn. otorinolar., No 6 (1971), p 55-57.
14. Novochadovskaya, T. V. Znacheniye vestibulyarnykh narusheniy v ekspertize trudospособности бол'nykh s posledstviyami zakrytoy cherepno-mozgovoy travmy ["Importance of Vestibular Disorders in Expert's Opinion of Work Capacity of Patients with After-Effects of Closed Craniocerebral Injury"], candidate dissertation, Moscow, 1965.
15. Polyakov, A. R. Otoneurologicheskaya semiotika ostrogo perioda chernno-mozgovoy travmy ["Otoneurological Semiotics of Acute Period of Cranio-Cerebral Injury"], author's abstract of candidate dissertation, Moscow, 1948.
16. Sutin, M. I. Zh. ushn., nos, i gorl. bol., No 5 (1967), p 75-78.
17. Sheps, S. I. Vopr. neyrokhir., No 6 (1975), p 27-30.
18. Schöder, H. HNO (Berl.), No 13 (1965), p 25-27.
19. Weldhagen, G. ibid. No 8 (1960), p 111-115.

COPYRIGHT: "VESTNIK OTOBINOLARINGOLOGII", 1980